Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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18	
19	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2014

Science A 2

SCA2FP

Unit 6

F

Thursday 12 June 2014 9.00 am to 10.30 am

For this paper you must have:
- a ruler
- the Chemistry Data Sheet and Physics Equations Sheet booklet (enclosed).

You may use a calculator.

Time allowed
- 1 hour 30 minutes

A

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 18 should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

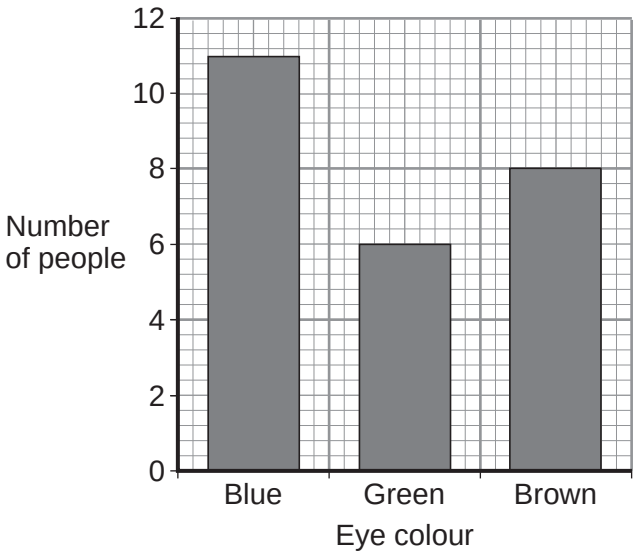
Answer **all** questions in the spaces provided.

Biology Questions

1 A student carried out a survey of eye colour in her class.

Her results are shown in **Figure 1**.

Figure 1



1 (a) What type of variable is eye colour?

Draw a ring around the correct answer.

[1 mark]

categoric **continuous** **control**

1 (b) (i) How many people in the class had blue eyes?

[1 mark]

Number of people with blue eyes = ...

1 (b) (ii) How many people were in the student's class?

[1 mark]

.....

.....

Number of people in the class = ...

1 (b) (iii) Give **one** conclusion that can be made from the data in **Figure 1**.

[1 mark]

.....

.....

1 (c) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

a cell	**a gene**	**nucleus**

Eye colour is controlled by ..... .

1 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

mother's milk	**enzyme**	**sex cells**

The information for eye colour is passed from parents to offspring

in the ..... .

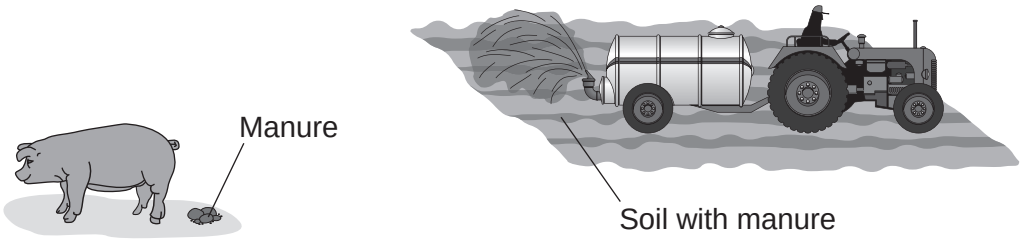
6

Turn over for the next question

2 Many farmers put pig manure on their crops to help the crops to grow as shown in **Figure 2**.

Pig manure contains carbon compounds. The carbon compounds are broken down during the process of decay.

Figure 2



2 (a) (i) What type of organism breaks down the carbon compounds in pig manure?

[1 mark]

.....

2 (a) (ii) The process of decay releases substances that are useful to crops.

Name **two** of these substances.

[2 marks]

Tick (✓) **two** boxes.

Carbon dioxide ☐

Light ☐

Nutrients ☐

Oxygen ☐

2 (b) Pig manure contains seeds from other plants, such as weeds.

What effect might weeds have on how fast the farmers' crops grow?

[2 marks]

.....

Give a reason for your answer.

.....

.....

5

Turn over for the next question

3 A group of students did a survey to find out where woodlice were found in a garden.

Their results are shown in **Table 1**.

Table 1

Habitat	**Number of woodlice**
On top of the soil	1
Under dead, dry leaves	6
Under dead, wet leaves	15

3 (a) From these results, which **two** environmental conditions do woodlice prefer?

[2 marks]

Tick (✓) **two** boxes.

Light ☐

Dark ☐

Warm ☐

Wet ☐

Dry ☐

3 (b) What piece of equipment could be used to measure **one** of the environmental conditions you gave in **(a)**?

[1 mark]

.....

3

4 **Figure 3** shows flamingos. Flamingos are birds. They have long legs.

They can walk in deep water and use their long necks to reach food in the mud.

Figure 3

How would Darwin have explained the evolution of the flamingo's long neck?

Use the correct answer from the box to complete each sentence.

[3 marks]

mutation	**natural selection**	**sexual reproduction**	**variation**

In a population of flamingos there are birds with different lengths of neck.

This range of differences in neck length is called ..... .

The flamingos with longer necks are better adapted to feed in deeper waters.
They are more likely to survive than flamingos with shorter necks.

This is an example of ..... .

The surviving flamingos pass on their genes for a longer neck to their offspring

during ..... .

3

Turn over for the next question

5 Some babies are allergic to a protein in cow's milk.

Scientists have created a genetically engineered cow called Daisy. Daisy produces milk that does not contain this protein.

The scientists inserted a gene into the DNA of a cow's skin cell. The gene stops the cow making the milk protein.

5 (a) What would have been used to insert the gene into the DNA of the cow's skin cell?

[1 mark]

Tick (✓) **one** box.

An enzyme ☐

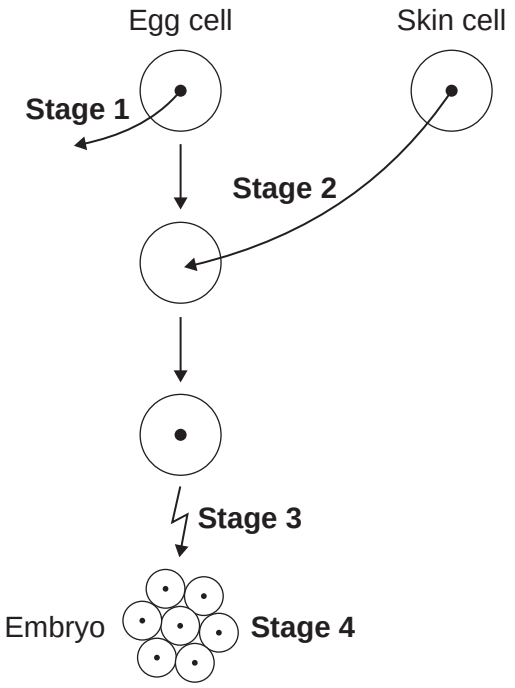
A mutation ☐

A hormone ☐

5 (b) **Figure 4** shows adult cell cloning.
The skin cell from the cow and an egg cell from another cow were used to produce an embryo by adult cell cloning. The embryo was inserted into the womb of a cow.

The embryo developed to form Daisy.

Figure 4



The sentences below describe how the skin cell and the egg cell are used to create the embryo by adult cell cloning.

Use information in **Figure 4** and your own knowledge to complete the following sentences.

[3 marks]

Stage 1 The nucleus is removed from the ..... and thrown away.

Stage 2 This nucleus is replaced with the nucleus from the ..... .

Stage 3 The new cell is made to start dividing by giving it ..... .

Stage 4 An embryo is formed.

4

Chemistry Questions

6 **Figure 5** shows some sausages.
Scientists have made sausages using vegetable oil instead of saturated animal fat.

Figure 5

6 (a) Sausages made with vegetable oil may be healthier to eat than sausages made with saturated animal fat.

Suggest why.

[1 mark]

.....

.....

6 (b) Vegetable oils are important foods.

Tick (✓) **one** reason why.

[1 mark]

Vegetable oils provide us with …	**Tick (✓)**
cornstarch.	
nutrients.	
water.	

6 (c) Some sausages are cooked in vegetable oil.

Some other sausages, for example 'hot-dog' sausages, can be cooked in water.

Give **two** differences between sausages cooked in vegetable oil and sausages cooked in water.

[2 marks]

.....

.....

.....

.....

4

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

7 **Figure 6** shows some Australian bank notes. In Australia bank notes are made of poly(propene) not paper.

Figure 6

7 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

emulsifier	**monomer**	**polymer**

Poly(propene) is made from propene.
In the reaction to make poly(propene), propene is the ..... .

7 (b) Propene is an alkene.
Bromine water is used to test for alkenes.

Use the correct answer from the box to complete the sentence.

[1 mark]

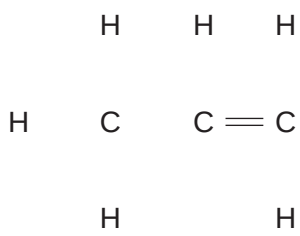
black	**blue**	**colourless**

When bromine water is added to propene the bromine water turns from

orange to ..... .

7 (c) (i) Propene has one double bond and seven single bonds.
Draw the missing bonds in the diagram to complete the displayed formula for propene.

[1 mark]



7 (c) (ii) What is the molecular formula of propene?

[1 mark]

.....

4

Turn over for the next question

8 Scientists have predicted what will happen to continents in 250 million years.

They have predicted that a new 'supercontinent' will be formed.
Figure 7 shows the present-day continents and two theories that have been proposed, **Theory 1** and **Theory 2**.

Figure 7

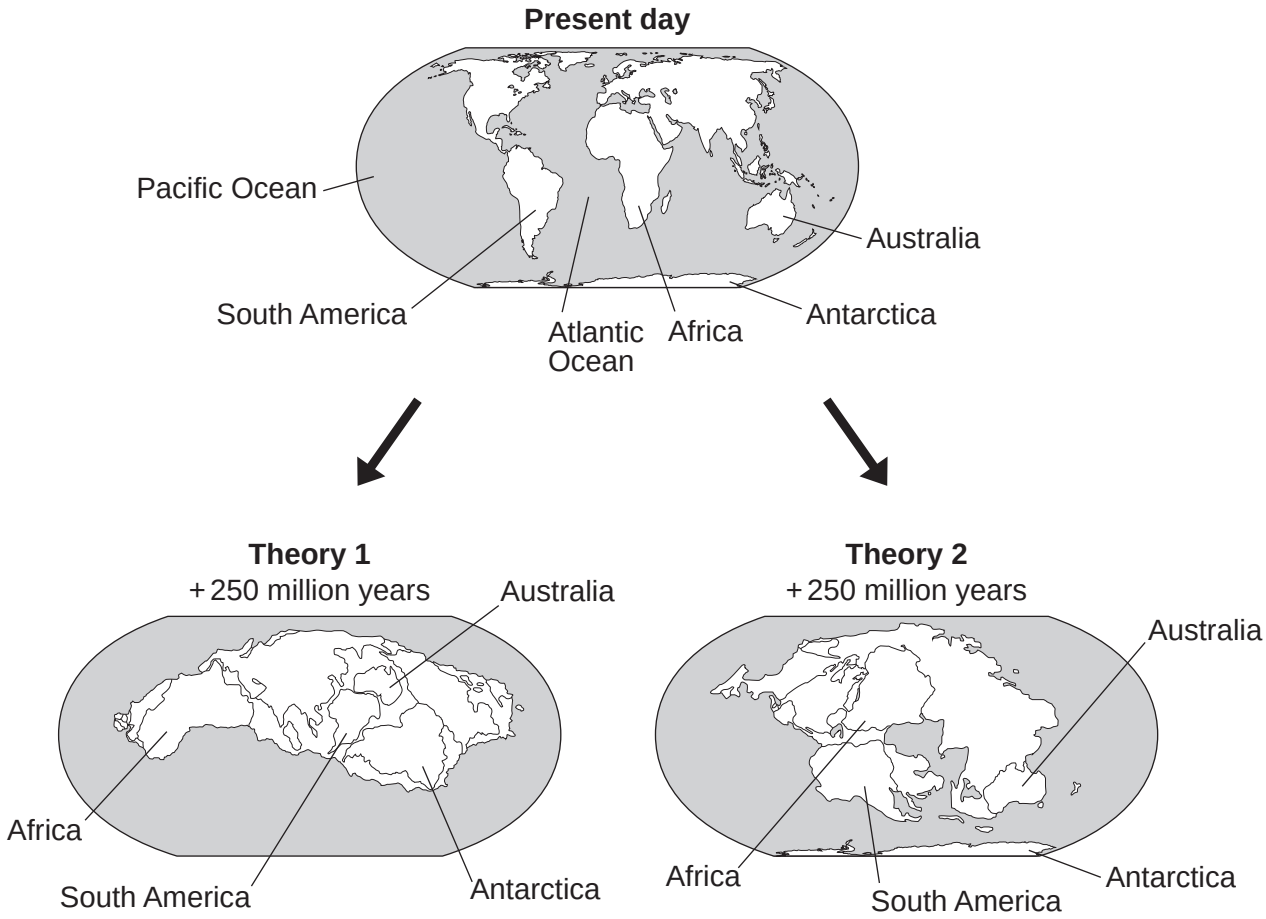


Table 2 shows details of the two theories.

Table 2

Theory 1	**Theory 2**
All continents move.	Antarctica stays at the south pole.
Pacific Ocean gets smaller.	Atlantic Ocean gets smaller.
South America and Antarctica join. Africa moves north; Australia moves north.	Africa moves north.
Completed in 250 million years.	Completed in 250 million years.
Predicted from what is happening now.	Predicted from where continents used to be.

8 (a) (i) Give **two** differences between the two theories.

[2 marks]

1 .....

.....

2 .....

.....

8 (a) (ii) Scientists do not know if either theory is correct.

Suggest why.

[1 mark]

.....

.....

8 (b) (i) Continents move because tectonic plates move.

Use the correct answer from the box to complete the sentence.

[1 mark]

day	**hour**	**year**

Tectonic plates move a few centimetres per ..... .

8 (b) (ii) Describe how tectonic plates move.

Use the correct answer from the box to complete each sentence.

[4 marks]

convection	**crust**	**heat**	**mantle**	**radioactive**	**steam**

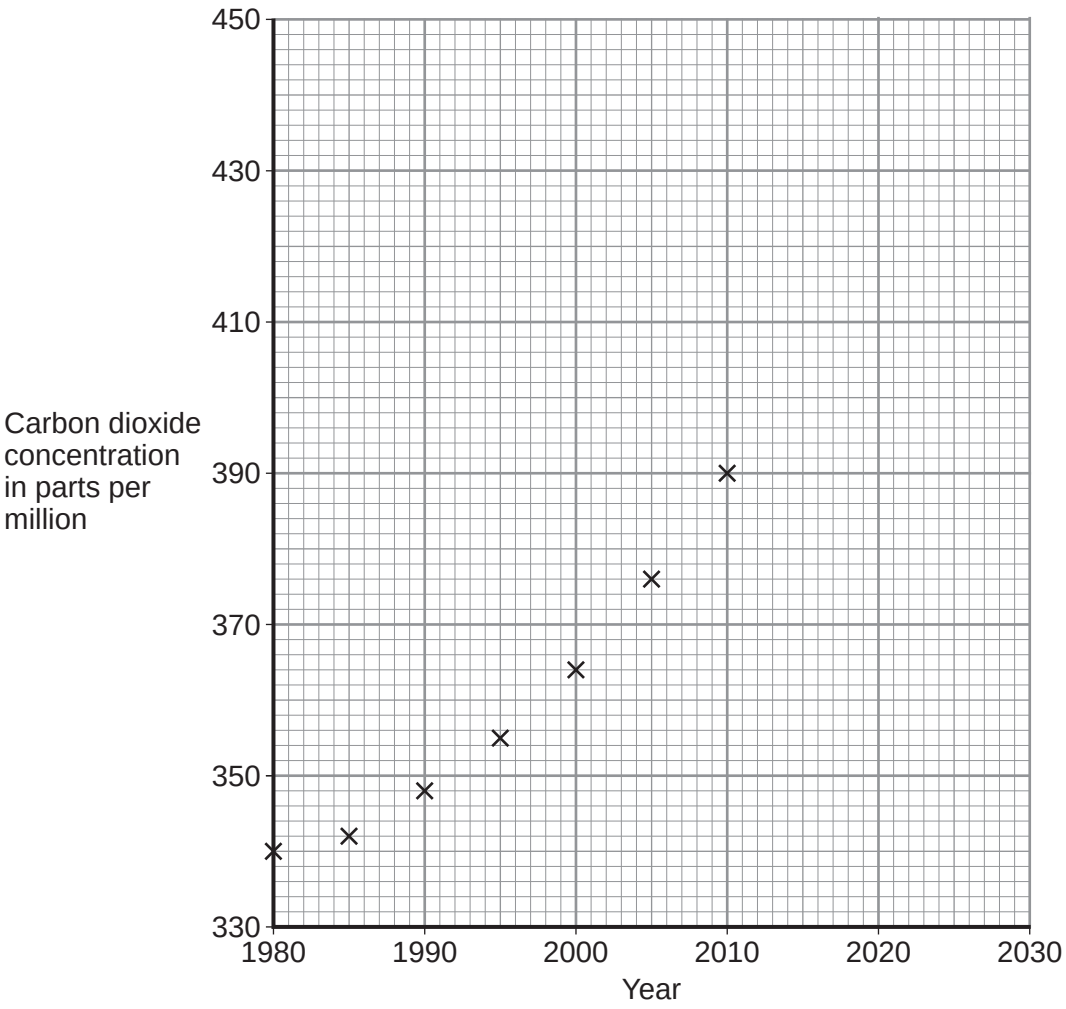
The movement of tectonic plates is driven by ..... currents within the ..... .

The currents are driven by ..... released by ..... processes.

8

9 **Figure 8** shows the concentration of carbon dioxide in the air from 1980 to 2010.

Figure 8



9 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

burning fossil fuels	**earthquakes**	**photosynthesis**

The main reason for the change in carbon dioxide concentration

is ..... .

9 (b) Scientists estimate that in 2020, the carbon dioxide concentration in parts per million will be 430.

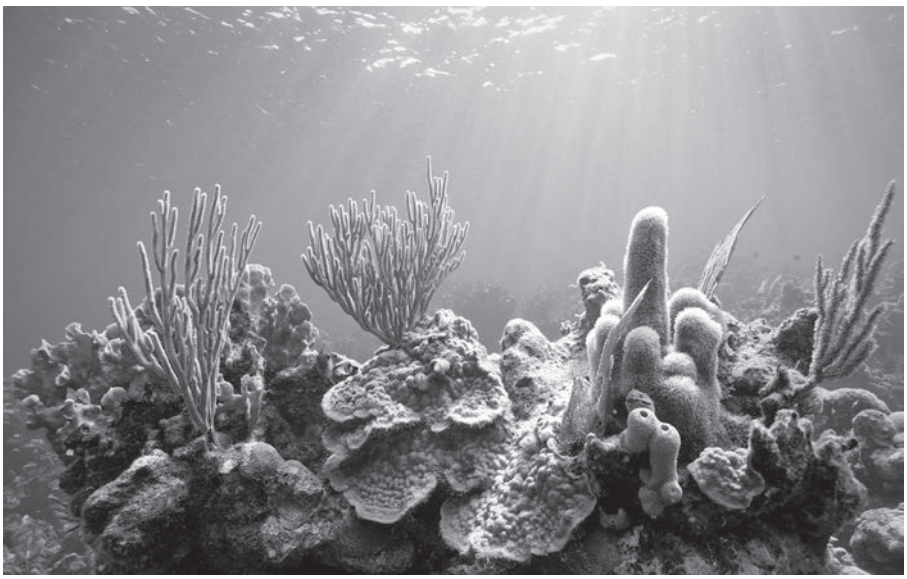
Plot this point on the graph.

Draw a line of best fit to complete the graph.

[2 marks]

9 (c) **Figure 9** shows part of the Great Barrier Reef. The Great Barrier Reef is in an ocean. The Great Barrier Reef is made of coral. Coral is made by tiny living organisms.

Figure 9



Scientists measured the amount of coral on the reef from 1980 to 2010.
The scientists used the data to predict the amount of coral on the reef in 2020.

The results are shown in **Table 3**.

Table 3

Year	Relative amount of coral
1980	100
2010	50
2020	25

Use information from **Figure 8** and **Table 3**.

What conclusion can you make about the change in carbon dioxide concentration in the air and the amount of coral on the reef from 1980 to 2020?

[2 marks]

.....

.....

.....

.....

5

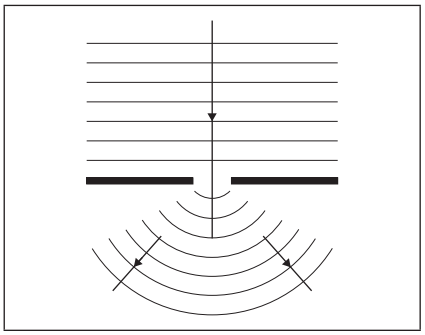
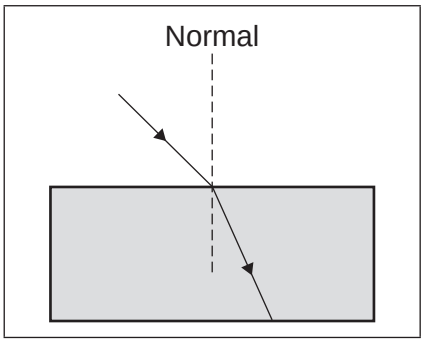
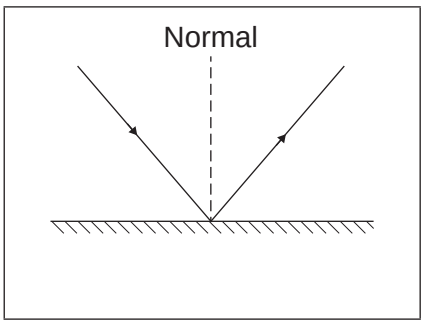
Turn over ▶

Physics Questions

10 Electromagnetic waves can be diffracted, reflected and refracted.

10 (a) Draw **one** line from each property to the correct diagram that demonstrates the property.

[2 marks]

Property	Diagram
Diffraction	
Reflection	
Refraction	

10 (b) Infrared, microwaves, radio waves and visible light can all be used for communication.

Draw **one** line from each part of the electromagnetic spectrum to its use.

[3 marks]

Part	Use
Microwaves	Photography
Radio waves	Remote controls
Visible light	Mobile phones
	TV broadcasts

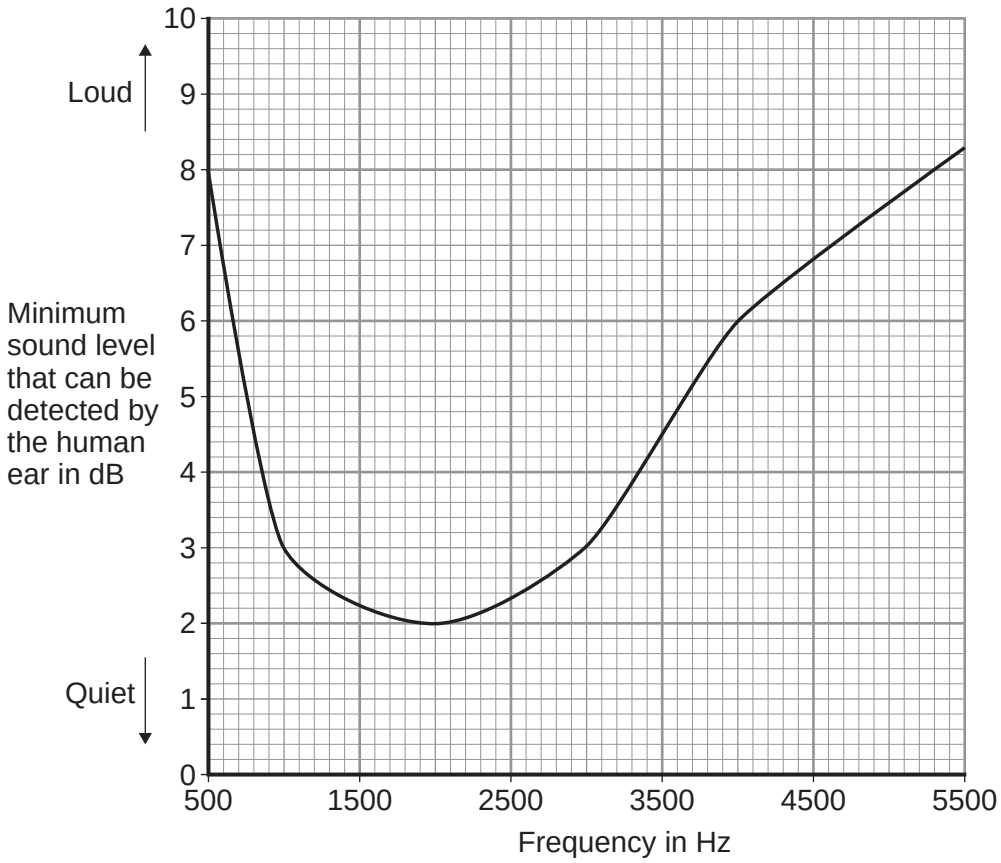
5

Turn over for the next question

11 The human ear can detect a range of frequencies of sound.
Sound level is measured in decibels, dB.

Figure 10 shows how the minimum sound level that can be detected by the human ear depends on the frequency of sound.

Figure 10



11 (a) A sound has a frequency of 2000 Hz.

What is the minimum sound level needed to detect the sound?

[1 mark]

Minimum sound level: ..... dB

11 (b) Which frequency shown in **Figure 10** would require the loudest sound before it could be heard?

[1 mark]

Frequency: ..... Hz

11 (c) The lowest frequency of sound the human ear can detect is 20 Hz. The wavelength of a sound wave with a frequency of 20 Hz is 17 metres.

Calculate the speed of a sound wave with a frequency of 20 Hz.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Speed = ... m/s

11 (d) Sound waves can be reflected from a wall.

What name is given to reflected sound waves?

[1 mark]

.....

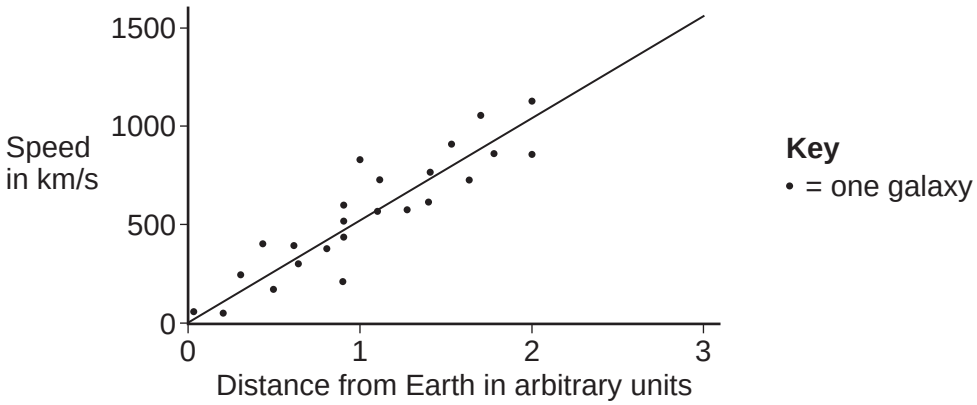
5

Turn over for the next question

12 In 1929, an astronomer called Edwin Hubble measured the distances of 24 galaxies from the Earth and the speeds at which the galaxies were moving away from the Earth.

Figure 11 shows his results.

Figure 11



12 (a) Why did Hubble present his data on a line graph rather than on a bar chart?

[1 mark]

.....

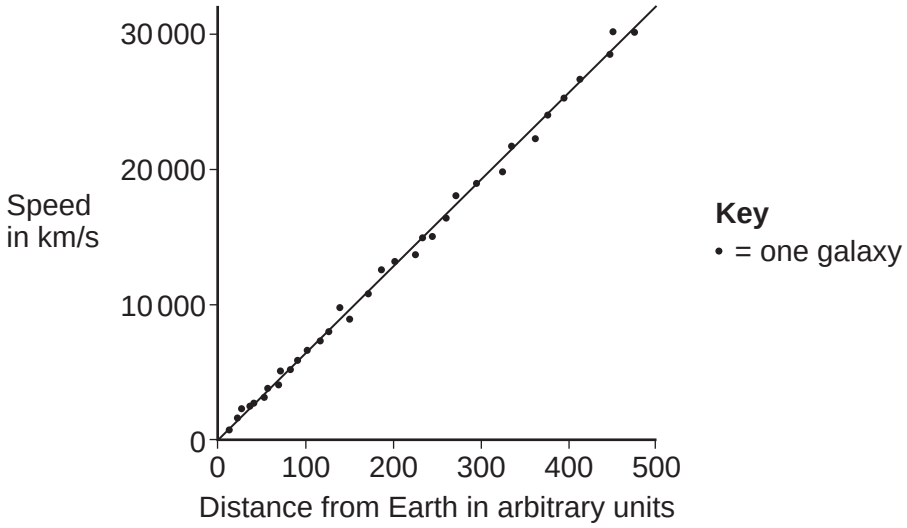
.....

12 (b) Hubble thought that the greater the distance, the greater the speed a galaxy was moving away. Hubble's conclusion was that the Universe was expanding.

Since Hubble made his conclusion more data has been collected about the speeds other galaxies are moving away from the Earth.

The data is shown in **Figure 12**.

Figure 12



Why does the data in **Figure 12** provide better evidence for Hubble's conclusion?

[2 marks]

Tick (✓) **two** correct answers.

Reasons	**Tick (✓)**
The galaxies are closer to Earth.	
More galaxies have been plotted on the graph.	
The galaxies are closer to each other.	
More distant galaxies also follow the same trend.	

12 (c) Hubble's conclusion supports the 'Big Bang' theory about the origin of the Universe. Another piece of evidence that supports the 'Big Bang' theory is Cosmic Microwave Background Radiation (CMBR).

What is **Cosmic Microwave Background Radiation**?

[2 marks]

Tick (✓) **two** correct answers.

	Tick (✓)
Sound waves left over from the Big Bang	
Electromagnetic radiation	
Radiation given off by microwave ovens	
Radiation that fills the Universe	

5

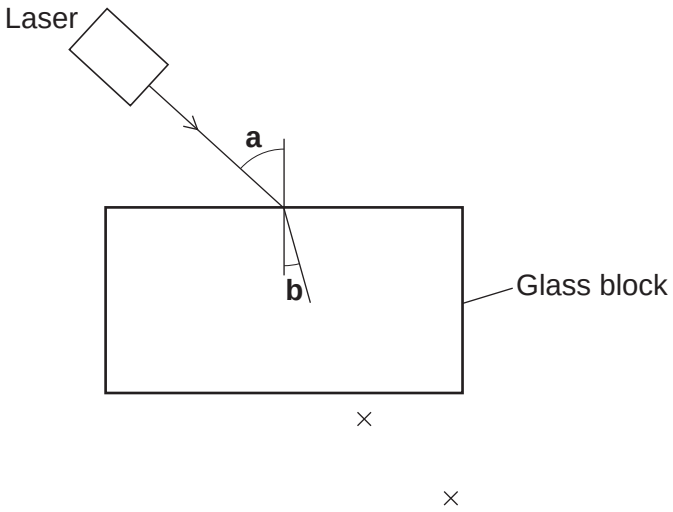
Turn over for the next question

13 A student used a laser to investigate the change of direction of light as it entered a glass block.

The apparatus is shown in **Figure 13**.

The path of a ray of light as it enters the glass block is shown.

Figure 13



13 (a) The student marked crosses to show the path of the ray of light that left the glass block.

Use a ruler to help you to draw the path of the ray of light through and out of the glass block.

[2 marks]

13 (b) Light from lasers can damage your eyes.

Suggest **one** safety precaution that the student should have taken during his investigation.

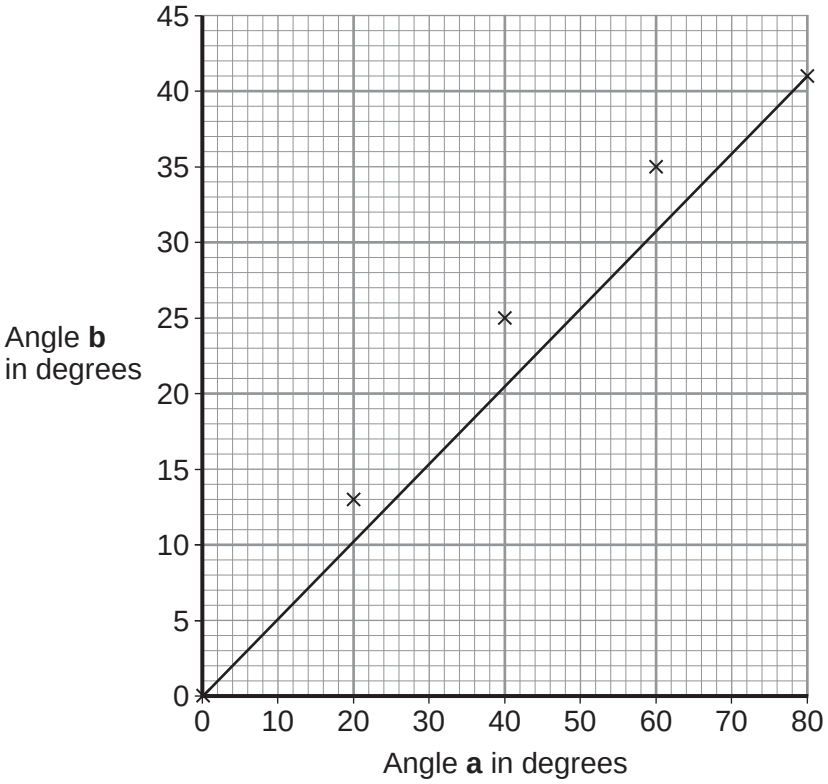
[1 mark]

.....

.....

13 (c) The student measured **angle a** and **angle b** when the ray of light was incident at 5 different angles. He measured each set of values once. The student's results are shown in **Figure 14**.

Figure 14



13 (c) (i) The student's line of best fit is **incorrect**.

Give **one** reason why.

[1 mark]

.....

.....

13 (c) (ii) The student measured 5 different values of **angle a** in his investigation.

Suggest **two** ways the student could improve his investigation.

[2 marks]

.....

.....

.....

.....

6

Turn over ▶

There are no questions printed on this page

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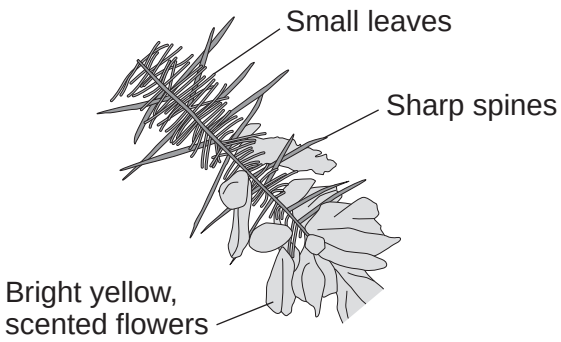
ANSWER IN THE SPACES PROVIDED

Biology Questions

14 **Figure 15** shows part of a gorse plant.

Gorse is a plant that can grow in dry soils in areas where there are strong winds. Gorse plants have deep roots. The roots produce a chemical that stops the growth of seeds of other plants.

Figure 15



Suggest how **each** of the following adaptations helps the gorse plant to survive.

[3 marks]

Small leaves .....

.....

Deep roots .....

.....

Roots that produce a chemical that stops the growth of seeds of other plants .....

.....

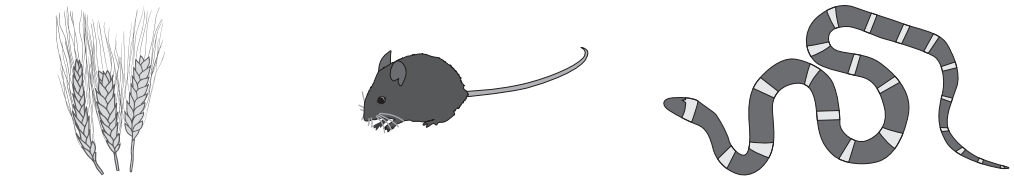
.....

3

Turn over for the next question

15 **Figure 16** shows a food chain and the total mass of organisms at each stage.

Figure 16



Barley
600 kg

→

Field mouse
80 kg

→

Snake
6 kg

Not to scale

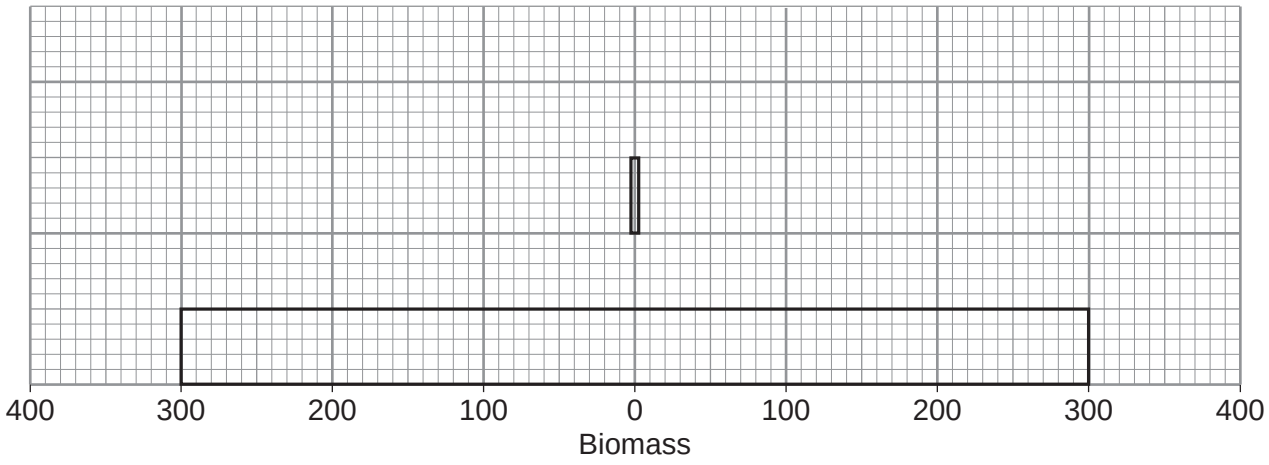
15 (a) (i) What is the source of energy for this food chain?

[1 mark]

.....

15 (a) (ii) **Figure 17** shows an incomplete pyramid of biomass for this food chain.

Figure 17



Complete **Figure 17**.

[3 marks]

Draw the missing bar to scale on the grid.

Label all the bars.

15 (b) The amounts of energy and biomass decrease along the food chain.

15 (b) (i) Why does energy decrease along a food chain?

Give **one** reason.

[1 mark]

.....

.....

15 (b) (ii) Why does biomass decrease along a food chain?

Give **one** different reason from your answer to **(b)(i)**.

[1 mark]

.....

.....

6

Turn over for the next question

Chemistry Questions

16 **Figure 18** shows a jar of mayonnaise.

Figure 18

Mayonnaise is an emulsion made from vegetable oil and vinegar.
Egg yolk can be used as an emulsifier.

A student added egg yolk to some vegetable oil and vinegar.

The student shook the mixture and timed how long the mixture took to separate.

The student repeated the experiment using different volumes of egg yolk, as shown in **Table 4**.

Table 4

Volume of egg yolk in cm^3	Time for mixture to separate in seconds			
	1	**2**	**3**	**mean**
0	40	43	39	41
2	157	149	156	154
4	256	259	271	262
6	372	376	356	368
8	472	467	471	

16 (a) (i) Calculate the mean value for the time taken for the mixture to separate when 8 cm^3 of egg yolk was added.

[1 mark]

.....

.....

16 (a) (ii) Give a conclusion for this investigation.

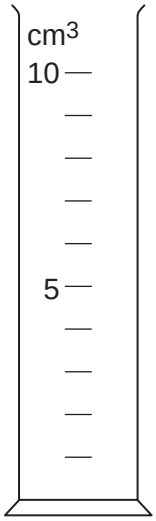
[1 mark]

.....

.....

16 (b) The student used a 10 cm^3 measuring cylinder as shown in **Figure 19** to measure the egg yolk.

Figure 19



What is the resolution of the measuring cylinder?

[1 mark]

.....

16 (c) In mayonnaise, oil and vinegar are used as an emulsion and not as two separate liquids.

Give **two** reasons why.

[2 marks]

1 .....

.....

2 .....

.....

5

17 In 1785, Henry Cavendish investigated gases in the air. Cavendish found a very small amount of an unknown gas. Cavendish predicted that the unknown gas was a new element.

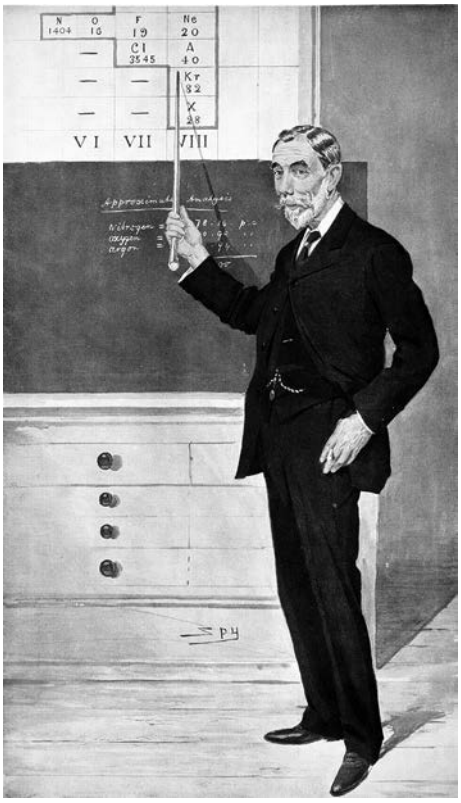
Figure 20 shows William Ramsay.

In 1894, William Ramsay:

- removed oxygen and carbon dioxide from dry air
- passed the remaining gases over hot magnesium.

The nitrogen reacted with magnesium to produce magnesium nitride. A very small amount of unreactive gas was left, which Ramsay named as a new element.

Figure 20



17 (a) Write a word equation for the chemical reaction that Ramsay used to remove nitrogen from the remaining gases.

[2 marks]

.....

17 (b) Name the type of gas that Ramsay discovered in the air.

[1 mark]

.....

17 (c) Suggest why Cavendish did not publish the discovery of a new element.

[1 mark]

.....

.....

4

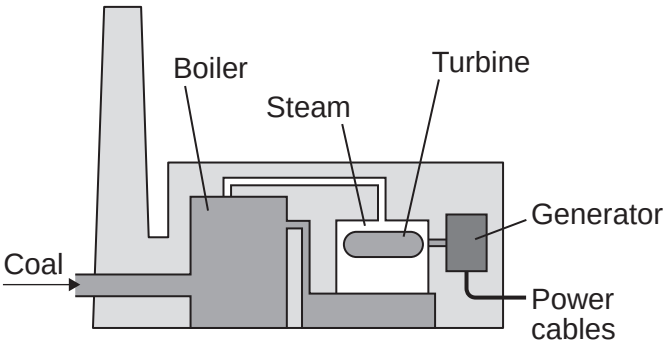
Turn over for the next question

Physics Questions

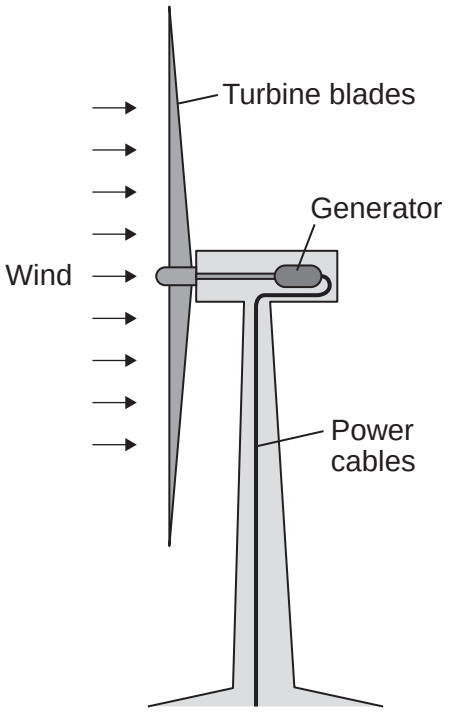
18 Electricity can be generated using different methods. Two methods of generating electricity are shown in **Figure 21**.

Figure 21

Coal-fired power station



Wind turbine



The diagrams are not drawn to scale.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Use the information in **Figure 21** and your knowledge to:

- describe the differences in these two methods used to generate electricity
- describe the possible environmental effects of the two methods.

[6 marks]

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Extra space .....

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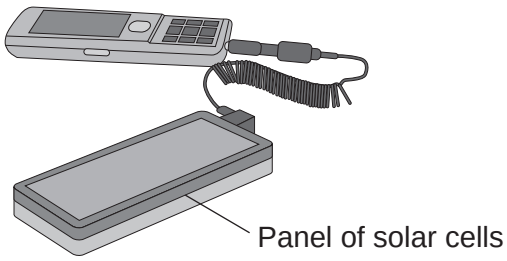
6

19 A student goes camping and uses a panel of solar cells to charge his mobile phone, as shown in **Figure 22**.

Figure 22



19 (a) Give **one** disadvantage of using a panel of solar cells to generate electricity to charge a mobile phone.

[1 mark]

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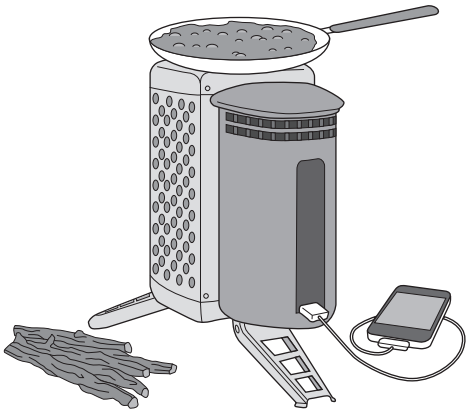
19 (b) A new camping stove has been invented that uses burning wood to cook food and to generate electricity.

Figure 23 shows the new camping stove and a fossil fuel gas camping stove.

Figure 23

New camping stove



Fossil fuel gas camping stove

The new camping stove has a USB connection to charge portable devices such as mobile phones.

Suggest **two** other advantages of using the new camping stove instead of a fossil fuel gas camping stove.

[2 marks]

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3

END OF QUESTIONS

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